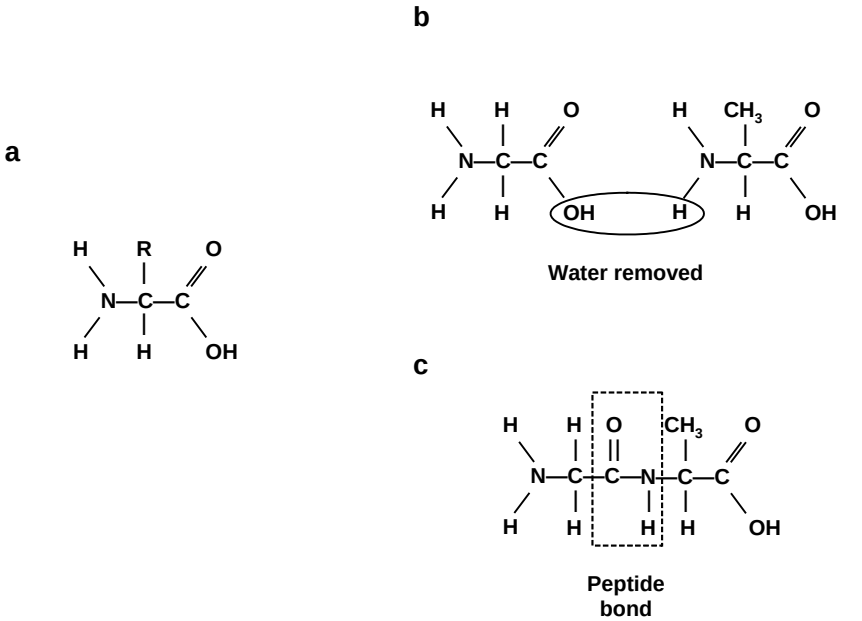

Figure 6.11. Basic steps in creation of peptide bonds in proteins. (a) Generic structure of an amino acid, where R represents the portion in which different amino acids vary. (b) Glycine (left) and alanine (right) bonding together with the removal of a water molecule. (c) The resulting peptide bond formed between glycine and alanine.

amino acids to bond to one another.[29] (Lipmann, as discussed earlier in this chapter, characterized such phosphate bonds as energy-rich bonds and theorized about how they were formed in oxidative phosphorylation.)

Robert Loftfield, who joined Zamecnik's group in 1948, had developed a procedure for labeling the amino acids alanine and glycine with C^{14}. In their first studies using these labeled amino acids, Zamecnik and his collaborators (Zamecnik et al., 1948) demonstrated uptake of alanine and glycine into tissue slices from normal and malignant rats. Working with tissue slice preparations presented serious limitations, and a number of research laboratories set out to develop a cell-free system in which to study the process.[30]

[29] Zamecnik commented, "As a student of Bergmann, I felt a loyalty to the catheptic enzymes, but as a neighbor of Lipmann, I developed a feeling that his concept of a phosphorylated intermediate might be correct, and the conviction that in any case C^{14}-labeled amino acids were a tool which might resolve this dilemma" (1958–9, p. 258).

[30] In Zamecnik's group, Elizabeth Keller initially led this effort. She injected rats with low doses of labeled amino acids and later sacrificed the animals, formed a homogenate from their liver cells, and centrifuged it. In rats sacrificed within twenty minutes she found most of the labeled amino acids in the microsomal fraction, but not after longer delays (Keller, 1951).